INL's PINS system identifies the contents of rusty, old munitions suspected of housing chemical warfare agents without discharging or exposing operators to hazards.

National Security

Idaho National Laboratory

Portable Isotopic Neutron Spectroscopy system

INL technology used world-wide to detect chemical, explosive warfare agents

The discovery by construction workers of nine 4,000 pound World War II-style bombs found in a former military shipyard near Baltimore in 2004 made headlines across the nation. What wasn't said is that an Idaho National Laboratory developed technology - the Portable Isotopic Neutron Spectroscopy system, or PINS - assisted the U.S. Army in determining the contents of the buried munitions without breaching the steel shell.

Similarly, in 2000 PINS was used at Rocky Mountain Arsenal near Denver to confirm the contents of six softball-sized World War I-M139 bomblets. In this case, the identification markings had corroded away from the old, rusty munitions. When assayed by PINS, the munitions were found to be filled with the deadly nerve agent Sarin.

Since 1992, this patented technology has been used by the U.S. Army, the Defense Threat Reduction Agency (DTRA) and the Department

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of Energy to identify suspect chemical and explosive warfare agents found in thousands of recovered munitions, stockpile items and other suspected hazards. More than 40 PINS systems are currently in use around the world in locations such as Australia, Egypt, Iraq, Japan and the United Kingdom. PINS is also used extensively at more than 100 sites overseas.

What is PINS?

PINS – a 1992 R&D 100 award winner – is a rugged, field-deployable, non-destructive evaluation tool that identifies the contents of munitions and chemical storage containers by employing neutron radiation safely and reliably. The system nonintrusively identifies material within steel and other containers using gamma spectroscopy.

Using a small amount of californium ^{252} as a radioactive neutron source, PINS shoots neutrons through the metal of a container. The neutrons interact with the elements inside and produce high-energy gamma rays. The gamma rays passing back out are detected by a spectrometer. Each chemical, nerve or explosive agent emits its own signature gamma rays, and the software within PINS analyzes the gamma ray spectra to identify the fill. Typically, the system can assay the contents of munitions within 100 to 1,000 seconds.

Developed for field deployment, PINS is both portable and tough. Its components include a small radioactive californium neutron source; a detector cooled by liquid nitrogen; a stand and shielding for the detector; a multichannel analyzer that sorts and stores the data; and a notebook computer for user interface. Customized software displays the data as it is gathered and offers powerful options for monitoring and analysis.

In more than a decade of use, PINS has become the premier tool for identifying nerve agents, blister agents, explosives, military screening smokes, compressed gases, and practice fills.

miniPINS

Just as powerful and accurate as the standard PINS system, a miniPINS system has also been developed by INL engineers. At 46 lbs., this system is less than half the weight of a traditional PINS system and requires less electrical power to operate and fewer shipping containers to deploy.

MiniPINS was developed to reduce set up time and shipping costs for its many customers who send the systems to field technicians around the country and around the world. MiniPINS and standard PINS are routinely used by the U.S. Army.

With its integrated components, miniPINS can be operated with less training than required by the standard PINS system. Both miniPINS and standard PINS use the same rigorously tested software and can operate for up to eight hours on a single battery source.

Advanced Research

Current research by INL engineers and PINS developers is looking at ways to increase system speed and sensitivity by replacing the californium source with a neutron generator. The use of a neutron generator would improve the system by allowing the radiation source to be turned on and off with a switch, and to be transported without a license from the Nuclear Regulatory Commission.

Early test results have concluded the use of a neutron generator to be as effective as the californium source, allowing the PINS systems to penetrate up to two inches of steel.

Whether it is a standard PINS or miniPINS system, both have clearly been established as a leading technology in their field. They are available for commercial purchase through the ORTEC business unit of AMETEK, Inc. in Oak Ridge, Tennessee.

For More Information

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INL is a U.S. Department of Energy national laboratory operated by Battelle Energy Alliance

PINS and miniPINS are rugged, field-deployable evaluation tools used to non-intrusively identify the contents of munitions and chemical storage containers by employing neutron radiation safely and reliably.